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Annex II
to the Protocol on Cooperation
in Aeronautical Science and Technology
between
the National Aeronautics and Space Administration
of the United States of America
and the
Chinese Aeronautical Establishment
of the
People's Republic of China

I. Purpose and Content of This Annex

This Annex specifies the understanding of the Parties with respect to the initial phase of cooperation under the Protocol on Cooperation in Aeronautical Science and Technology. The Parties agree to hold two symposia in the following subject areas:

(a) Symposium on structural analysis methods.

(b) Symposium on theoretical and experimental research in combustion fundamentals.

II. Scope of the Symposia

A. Each symposium shall include a five-day meeting involving five senior specialists each from the National Aeronautics and Space Administration of the United States of America and the Chinese Aeronautical Establishment of the People's Republic of China with the participation of 5-10 scientists as observers from the hosting country. A portion of each symposium will be devoted to presentations of technical papers by each side, according to an agenda mutually agreed to three months prior to the symposium. Following the presentations, extensive discussion of the papers and related technology issues will take place. Following each symposium, the hosting country will provide a tour of facilities related to the subject of the symposium.

B. In the Structural Analysis Methods Symposium, the subjects will include theoretical considerations, solution algorithms, computer implementations and experimental verification. In the Combustion Fundamentals Symposium, theoretical subjects will include combustion kinetics, chemical reactions, and thermodynamics.

C. Experimental research presented in the symposia will include data to arrive at analytical models as well as to verify theoretical predictions.

III. Location of Symposia

A. The Symposium on Structural Analysis Methods will be held in Beijing, China.

B. The Symposium on Theoretical and Experimental Research in Combustion Fundamentals will be held at or near the NASA Lewis Research Center, Cleveland, Ohio, U.S.A.

IV. Allocation of Costs

The Parties agree that conditions as to the availability of funds and manpower will be as provided under Article 4 of the Protocol on Cooperation in Aeronautical Science and Technology, and that the allocation of costs for activities during this initial phase of cooperation will be as provided for mutual exchanges in that Article.

V. Schedule of Symposia

A. The Symposium on Structural Analysis Methods will be held as soon as possible but no later than six (6) months after the effective date of this Annex.

B. The Symposium on Theoretical and Experimental Research in Combustion Fundamentals will be held within three (3) to six (6) months thereafter.

VI. Public Information

Release of public information regarding this initial phase of cooperation may be made by the appropriate agency for its own portion of the activities as desired and, insofar as participation of the other is involved, after suitable consultation.

VII. Effective Date and Duration

This Annex shall become effective upon signature by both Parties and shall remain in effect through completion of the second symposium or as mutually agreed by both Parties.

Done at Beijing, on the fifth of April of 1985, in duplicate in the English and Chinese languages, both equally authentic.

For the
National Aeronautics and
Space Administration of
The United States of
America

Jack L. Gossell

For the
Chinese Aeronautical
Establishment of the
People's Republic of
China

ANNEX III TO THE PROTOCOL
ON COOPERATION IN
AERONAUTICAL SCIENCE AND TECHNOLOGY
BETWEEN
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
OF THE UNITED STATES OF AMERICA
AND
THE CHINESE AERONAUTICAL ESTABLISHMENT OF
THE PEOPLE'S REPUBLIC OF CHINA

I. Purpose and Content of This Annex

This annex specifies the understanding of the parties with respect to the second phase of cooperation under the Protocol on Cooperation in Aeronautical Science and Technology.

II. The parties agree to participate in the following activities during the second phase of cooperation:

A. Fatigue and fracture mechanics cooperative program

B. Symposium on propulsion research instrumentation

C. Symposium on fundamental experimental aerodynamics

III. Scope of Fatigue and Fracture Mechanics Cooperative Program

A. The objective of this cooperative research program is to identify and characterize the crack initiation and growth of small (surface and corner) cracks in commonly-used United States and Chinese material systems under constant-amplitude and spectrum loading. A tensile sheet specimen with a semi-circular edge notch, which has been used in previous NASA studies, will be used for this program. For large through-the-thickness cracks (lengths greater than 2 MM), the crack-closure mechanism will be studied to improve the understanding of the fatigue crack-growth process. Surface cracks will also be obtained in the same materials under various types of loading: tension, bending, and shear. The crack-growth properties (rate and direction) will be measured by commonly used methods. The data generated for large through-the-thickness cracks and for surface cracks will be used to assess the small-crack effect under the various load histories.

B. NASA will use its best efforts, consistent with program priorities, to :

1. Provide 7075-T6 aluminum alloy sheet material.

2. Test U.S. and Chinese material systems and all specimen types.

3. Provide special crack-opening measurement gauges for the purpose of measuring closure efforts.

4. Provide analytical correlation of all test results including 3-D finite element analysis (stress intensity factor solution) and life prediction for crack configurations used in the program

C. CAE will use its best efforts, consistent with program priorities, to:

1. Provide an equivalent Chinese alloy similar in strength and ductility to 7075-T6.

2. Test U.S. and Chinese material systems and all specimen types.

3. Provide 3-D weight function analytical solutions for the crack configurations used in the program.

4. Provide an aircraft-type spectrum loading to be used in the program.

D. NASA and CAE will develop a joint technology test plan, including schedule. This plan will cover the type and number of specimens to be tested, load conditions, required specimen instrumentation, establishment of analysis/test data correlation needs, and reporting format. At an agreed time, NASA and CAE will exchange one to two researchers each to participate in the other side's test and interact with researchers for a one- to two-week time period. A final meeting for evaluation of all results will be held at NASA Langley Research Center, Hampton, Virginia. CAE will send one to two specialists to participate in the final review for a one- to two-week time period. This review will cover all significant test and analytical results for this Aluminum Alloy Fatigue and Fracture Mechanics Cooperative Program.

E. Technical representatives for development of this cooperative program will be Mr. Samuel L. Venneri, Director, Material and Structures Division, NASA Headquarters, and Mr. Li Chenggong, Chief Engineer, Institute of Aeronautical Materials, CAE.

IV. Scope of the Symposia

A. Each symposium shall include a five-day meeting involving five senior specialists each from the National Aeronautics and Space Administration of the United States of America and the Chinese Aeronautical Establishment of the People's Republic of China with the participation of 5-10 scientists as observers from the hosting country. A portion of each symposium will be

devoted to presentations of technical papers by each side, according to an agenda mutually agreed to three months prior to the symposium. Following the presentations, extensive discussion of the papers and related research issues will take place. Following each symposium, the hosting country will provide a tour of facilities related to the subject of the symposium. Total duration of stay by the visiting delegation in the hosting country will not exceed two weeks.

B. In the Propulsion Research Instrumentation Symposium, the following specific topic areas will be covered:

1. High temperature structural strain instrumentation

2. Aerothermal environment instrumentation

3. Instrumentation for droplet size and distribution in two-phase flow

C. In the Fundamental Experimental Aerodynamics Symposium, the following specific topic areas will be covered:

1. Flow visualization of large structures in turbulent boundary layers

2. Coherent structures in boundary layers (Vortex/boundary layer interactions)

3. Unsteady boundary layers (e.g., helicopter retreating blade stall)

4. Wind tunnel wall interference in transonic flow

D. Experimental research presented in the symposia will include data to arrive at analytical models as well as to verify theoretical predictions.

E. Location of symposia

1. The Symposium on Propulsion Research Instrumentation will be held in either Beijing, China, or Aero-Gas Turbine Research Institute, Jiangyou, Sichuan Province, China

2. The Symposium on Fundamental Experimental Aerodynamics will be held at or near the NASA Langley Research Center, Hampton, Virginia, U.S.A.

F. Schedule of symposia

1. The Symposium on Propulsion Research Instrumentation will be held in September, 1986.

2. The Symposium on Fundamental Experimental Aerodynamics will be held in the spring or summer of 1987, on a date to be mutually agreed by January, 1987.

V. Allocation of Costs

The parties agree that conditions as to the availability of funds and manpower will be as provided under Article 4 of the Protocol on Cooperation in Aeronautical Science and Technology, and that the allocation of costs for activities during the second phase of cooperation will be as provided for mutual exchanges in that article.

VI. Public Information

Public release of information regarding the second phase of cooperation may be made by the appropriate agency for its own portion of the activities as desired and, insofar as participation of the other is involved, after suitable consultation.

VII. Effective Date and Duration

This Annex shall become effective upon signature by both parties and shall remain in effect through completion of the Fatigue and Fracture Mechanics Cooperative Program and the two symposia or as mutually agreed by both Parties.

Done by correspondence on the July 9, 1986 and the August 15, 1986 respectively, in duplicate in the English and Chinese language, both equally authentic.

Raymond A. Colladay

For the
National Aeronautics and Space Administration of the United States of America

For the
Chinese Aeronautical Establishment of the People's Republic of China